NASA SCIENCE MISSION DIRECTORATE

Earth-Sun System Applied Sciences Program
Homeland Security Program Element
FY 2005-2009 Plan

Version 1.1

March 16, 2005

Expanding and accelerating the realization of economic and societal benefits from Earth-Sun System science, information, and technology

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NASA Science Mission Directorate
Earth-Sun System Division
Applied Sciences Program

Applied Sciences for the Homeland Security Program Element

This document contains the Homeland Security Program Element Plan for Fiscal Years 2005-2009. This plan derives from direction established in the NASA Strategic Plan, the Earth Science Enterprise Strategy, the Space Science Enterprise Strategy, the Earth Science Applications Plan, and OMB/OSTP guidance on research and development. The plan aligns with and serves the commitments established in the NASA Integrated Budget and Performance Document.

The Program Manager and the Applied Sciences Program leadership have reviewed the plan and agree that the plan appropriately reflects the goals, objectives, and activities for the program element to serve the Applied Sciences Program, the Earth-Sun System Division, NASA, the administration, and society.

(Signature on file) February 11, 2005
Stephen Ambrose Date
Program Manager, Homeland Security
Applied Sciences Program
NASA Earth-Sun System Division

(Signature on file) February 11, 2005
Lawrence Friedl Date
Lead, National Applications
Applied Sciences Program
NASA Earth-Sun System Division

(Signature on file) February 11, 2005
Ronald J. Birk Date
Director, Applied Sciences Program
NASA Earth-Sun System Division

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NASA Earth-Sun System Division: Applied Sciences Program
Homeland Security

TABLE OF CONTENTS

.

NASA Science Mission Directorate – Applied Sciences Program

Homeland Security Program Element Plan: FY 2005 - 2009

I. Purpose and Scope

This plan articulates the goals and direction of the Homeland Security Program Element for the period from Fiscal Year (FY) 2005 to 2009 by detailing the purpose of the program and our strategy to fulfill the Homeland Security mission with the resources available. The plan describes the Program's scope, including NASA's role in partnerships, the focus on decision support tools, and the types of Earth-Sun system science results we seek to extend. Within the Earth-Sun System Division, this plan functions as a program management tool, describing the program structure, functional mechanisms, performance measures, and general principles that the Homeland Security activity will follow. The plan includes projects in which Earth-Sun system science results can be applied to decision making with related socioeconomic benefits.

The Homeland Security Program Element is one of twelve elements in the NASA Applied Sciences Program. NASA and the Applied Sciences Program collaborate with partner organizations to enable and enhance the application of NASA's Earth-Sun system science results to serve national priority policy and management decision support tools. The desired outcome is for partner organizations to use project results, such as prototypes and benchmark reports, to enable expanded use of NASA Earth-Sun system science products and to enhance their decision support capabilities.

The Science Mission Directorate Homeland Security Program Element is designed to advance the use of NASA's thirty Earth-Sun spacecraft missions and 100 sensors. NASA Earth-Sun system science results are expected to meet a number of homeland security needs.

The Homeland Security Program Element extends products derived from Earth-Sun system science information, models, technology, and other capabilities into partners' decision support tools for homeland security issues of national priority. The Homeland Security Program addresses such areas of concern and decision-making as chemical, biological, nuclear, and radiological terrorism; geospatial enabling of homeland security operation; and national security issues. The Homeland Security Program focuses on decision tools related to the following classes of issues:

- Homeland security planning and decision support system strategies
- Integrated Operation Facility development, such as air transport and diffusion
- Coordination with the National Response Plan with the U.S. Department of Homeland Security (DHS) and the Office for the Federal Coordinator for Meteorology (OFCM)
- Information technology, interoperability, and Web services
- Research and development of model and data assimilation and prediction
- Coordination with international security issues
- Economic management and "the built" environment (buildings and physical structures)
- Public response, recovery, mitigation, and welfare

Within the guidance and charter of the NASA Homeland Security Tiger Team (HSTT), the NASA Homeland Security Program Element works with NASA partners, federal agencies, and regional and national organizations that have homeland security responsibilities and mandates to support homeland security managers. Primary partners are the U.S. Department of Homeland Security (DHS), the Humanitarian Information Unit of the State Department, the Defense Threat Reduction Agency (DTRA), the Department of Defense (DOD), the National Oceanic and Atmospheric Administration (NOAA), the United States Environmental Protection Agency (EPA), the Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), and the U.S. Department of Agriculture (USDA). The Program includes international organizations with U.S. partners as appropriate. NASA Homeland Security Program Element activities relate to other national priority Program Elements including Public Health, Agricultural Efficiency, Disaster Management, Aviation, Air Quality, Energy Management, and Ecological Forecasting. Through its activities, the Program provides results that support the White House Committee on Environment and Natural Resources (CENR), the Homeland Security Committee, OFCM, the Federal Committee for Meteorological Services and Supporting Research (FCMSSR) and the interagency programs on Climate Change Science and Technology (CCSP, CCTP).

Priority NASA Earth observing missions for the Homeland Security Program include Terra, Aqua, Quick Scatterometer (QuikSCAT), CloudSAT, Tropical Rainfall Measuring Mission (TRMM), National Polar-orbiting Operational Environmental Satellite System (NPOESS), NPOESS Preparatory Project (NPP), Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO), and Gravity Recovery and Climate Experiment (GRACE). Priority models include the EPA's Aerial Locations of Hazardous Atmospheres (ALOHA®), NOAA's Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT), the Pennsylvania State University/National Center for Atmospheric Research Mesoscale Model (MM5), and the National Center for Environmental Prediction Event Tree Analysis (ETA) model. Other models of importance to the Homeland Security Application consist of air plume transport models. NASA's role in air transport and diffusion models will be to bridge the gap from mesoscale to microscale/urban scale. This was identified as an important need in the Office of Federal Coordinator for Meteorology (OFCM) report: "Federal Research and Development Needs and Priorities for Atmospheric Transport and Diffusion Modeling".

The project plans associated with the Homeland Security Program designate specific sensors and models, and they state specific partnership activities to extend science measurements, environmental data records, and geophysical parameters.

This plan covers objectives, projects, milestones, and activities for FY 05-09. In FY04, the Program's priority activities focused on activities with the Joint Action Group (JAG) of the Office of the Federal Coordinator for Meteorology (OFCM) and extending the development of a Research and Development (R&D) Plan for air plume transport and modeling. In FY05-09, the Program's priorities focus on extending NASA research results to support the Interagency Modeling and Atmospheric Assessment Center (IMAAC) at the Department of Homeland Security (http://www.dhs.gov).

Scope within NASA and Applied Sciences Program

The Homeland Security Program Element is managed in accordance with, and is guided by, the NASA Strategic Plan and Earth Science Enterprise Strategy. The program element benefits from Earth-Sun system science results and capabilities including Operation System Simulation Experiments (OSSEs), Project Columbia, the Joint Center for Satellite Data Assimilation (JCSDA), the Earth-Sun System Gateway (ESG), and the Transition from Research to Operations (R2O). The program element utilizes initiatives such as the Global Information Grid (GIG) and Federal Enterprise Architecture (FEA) and cooperates with national Earth-Sun laboratories and international programs.

The FY05 President's Budget for the NASA Applied Sciences Program* specifies $54M annually for FY05-FY09 for the National Applications ($24M) and Crosscutting Solutions ($30M) activities. While directly managing a subset of the $24M National Applications budget, the Homeland Security Program Element (and each of the national applications) benefits from the performance results of the $30M budget for Crosscutting Solutions (see Crosscutting Solutions Program Element Plan). The Homeland Security Program Element leverages and extends research results from the approximately $2.1B per year supporting Earth-Sun system science research and development of innovative aerospace science and technology.

Additional information about the NASA Applied Sciences Program can be found at http://science.hq.nasa.gov/earth-sun/applications.

** The National Applications and Crosscutting Solutions components of the Earth Science Applications Theme in the NASA FY05 Integrated Budget & Performance Document*

II. Goals and Objectives

The goal of the Homeland Security Program is as follows:

Enable partners' beneficial use of NASA Earth-Sun System science research, observations, models, and technologies to enhance decision support capabilities serving their homeland security responsibilities.

Major tenets of the Homeland Security Program's goals include the following:

- Develop and evolve a network of partnerships with appropriate homeland security organizations, both internal and external to DHS
- Identify and assess partners' homeland security responsibilities, plans, and decision support tools and evaluate the capacity of NASA science results to support these partners
- Validate and verify applications of results with partners, including development of products and prototypes to address partners' requirements
- With partners, document the value of Earth-Sun System science results in decision support tools and support the tools' transition from research to operations.
- Communicate results and partners' achievements to appropriate homeland security communities, committees, and stakeholders

Objectives
The Homeland Security Program serves the NASA Strategic Plan Objectives and the NASA Integrated Budget and Performance Document (IBPD) Performance Measures Outcome 3.1.1, Goal 5ESA9. This goal crosscuts a number of other programs related to weather, public health, climate, air quality, and agriculture but specifically states expected results in the area of national security.

Specifically, the Homeland Security Program pursues the following short-term (two year) and long-term (five year) objectives that meet the requirements of the FY05 IBPD:

Short-term (Major Milestones) Objectives (FY05)

February 2005	Complete signing of IMAAC MOA with DHS and other agencies Deliver plan to FCMSSR/OFCM
May 2005	Publish article/paper on potential Earth-Sun System Science input to homeland security decision tools *(QuikSCAT, Terra, Aqua, GRACE)*
August 2005	Complete an evaluation report and schedule a results workshop on potential homeland security related Earth-Sun system science missions Complete Subcommittee on Disaster Reduction report on homeland security needs addressed through hazards research and Grand Challenges
September 2005 *Goal 5ESA9*	Validate science inputs from at least three sensors and models into at least two separate homeland security decision tools and policy/management activities – air plume modeling, and assessment capability (Terra, Aqua, GRACE, QuikSCAT, TRMM)

Long-term Objectives (FY06-FY09)

January 2006	Complete evaluation report on at least one additional homeland security decision support tool, such as food security, energy, or transportation related. Collaborate with other NASA applications. *(report to specify science measurements and models)*
June 2006	Complete benchmark report(s) and schedule a results conference on Earth-Sun system science support for at least one more homeland security decision support tool
September 2007	Publish at least one article on Earth-Sun system science homeland security programs, including a contribution to at least one peer-reviewed journal. Encourage support and utility of InSAR spacecraft observations in support of homeland security.

September 2008	Complete benchmark reports and conduct results conferences on at least two separate homeland security issues and corresponding decision support tools using NASA research and pathfinder missions observations and predictions for model capacity
December 2008	Benchmark new mission observations from at least two sensors (NPOESS, GPM, InSAR) as they become "operational" for homeland security applications.

III. Program Management and Partners

Program Management

Homeland Security Program Manager: *Stephen Ambrose, NASA-Headquarters*

Responsibilities:

- Program development, strategy, plans, and budgets
- Program representation, advocacy, and issues to Applied Sciences management and beyond
- Communication of Earth-Sun System science priorities and directives to Homeland Security Program team/network
- Implementation of interagency agreements and partnerships
- Monitoring of Homeland Security Program metrics and performance evaluation

Homeland Security DHS IMAAC Director and NASA detailee to DHS:

Dr. Bruce Davis, NASA-DHS Washington, DC

Responsibilities:

- Leadership on project plans, development, performance, and partnership relationships in collaboration with the IMAAC.
- Communication of project metrics, performance, status, and issues to Program Manager
- Coordination between NASA Centers on Homeland Security Program activities
- Management for grants and cooperative agreements assigned to Stennis (SSC)

Homeland Security Deputy Program Manager:

Dr. Rodney McKellip, NASA-SSC

Responsibilities:

- Leadership on project plans, development, performance, and partnership relationships
- Communication of project metrics, performance, status, and issues to Program Manager
- Leadership and communication to Homeland Security Program team and network
- Coordination between NASA Centers on Homeland Security Program activities
- Management for grants and cooperative agreements assigned to SSC
- Management of Homeland Security Program tasks assigned to SSC

Networks

Primary contacts within NASA Centers and federal partner agencies that are enabling NASA capabilities to the Homeland Security Program are listed below. This list is not exhaustive; only

the primary program managers and focal points for specific and major projects or subject areas are provided.

NASA Center and HQ Contacts

Mr. Ron Blom (Geology) - Jet Propulsion Laboratory (JPL)
Dr. James Brass/Vince Ambrosia (Wildfire) - Ames Research Center (ARC)
Dr. Steve Goodman (Weather, Severe Storms, AWIPS) –
Marshall Space Flight Center (MSFC)
Dr. Shahid Habib (Hurricane, AWIPS, Landslide, Precipitation, Fire) –
Goddard Space Flight Center (GSFC)
Dr. John Murray (Weather, U.S. Weather Research Program (USWRP) –
Langley Research Center (LaRC)
Dr. John LaBrecque – Geodetic Imaging, Hazard Research
Ms. Myra Bambacus – Geospatial Interoperability Office (GIO), GSFC
Dr. Gran Paules – Technology Division
Ms. Kitty Havens – International and Interagency Activities
Ms. Elizabeth Williams – International Affairs
Dr. Nevin Bryant – JPL
Dr. Herb Frey – GSFC
Mr. Michael Pascioto – Technology Development Manager
Dr. Donald Deering – NEESPI – GSFC
Mr. Randal Albertson – DFRC
Mr. Ranty Liang – JPL
Dr. David Tralli – JPL
Mrs. Elizabeth Plentovich - LaRC

Federal Partners

DHS

Ms. Nancy L. Suski – DHS Emergency Preparedness and Response
Mr. Chris Doyle – DHS, Emergency Preparedness and Response
Ms. Claire Drury - Federal Emergency Management Agency (FEMA),
Mitigation Division
Mr. Ed Laatche – FEMA, Program Policy and Assessment Branch
Mr. Cliff Oliver – FEMA HAZUS

NOAA

Mr. Bruce Hicks – NOAA Air Resources Laboratory
Dr. Paula Davidson – National Weather Service Headquarters
Ms. Debbie Payton – NOAA National Ocean Service, Office of Response and Restoration (NOS OR&R), Hazardous Materials Response Division (HAZMAT)

USDA

Mr. Paul Greenfield – USDA Forest Service Headquarters
Mr. Glenn Bethel – USDA Forest Service Headquarters
Ms. Diane DiPietri – USDA Homeland Security Office

Industry

Dr. Robert Ryan – SSAI
Dr. Lisa Warneke – Consultant
Ms. Mary Ellen Brown – GeoData Systems
Mr. Ronnie Yaron – Skyline Software
Ms. Sue Gray – Sky Research, Inc
Mr. Tom Strange – General Dynamics, SSC
Mr. Brian Tucker – Geohazards International

University

Dr. Douglas Stow – Sand Diego State University
Dr. John Jensen – U of S. Carolina
Dr. Ray Williamson – George Washington University
Dr. David W. S. Wong – George Mason University
Dr. Richard Gomez – George Mason University
Dr. Linda Musial – Charles County Public Schools
Mr. William Craig – U. of Minnesota
Mr. Michael A. Rosenblum – MIT
Dr. Arlin Kruger – U MD
Dr. Michael Hodgson – U. S. Carolina
Dr. Menas Kafatos – George Mason U.

Domestic

Climate Change Technology Program (CCTP) – The OFCM Joint Action Group (JAG) Applied Sciences Program leads the CCTP group on measurements and monitoring. The Homeland Security program supports this effort.

Climate Change Science Program (CCSP) – Joint federal program of the President's Committee on Climate Change Science and Technology Integration has issued its strategic plan to address some of the most complex questions and problems dealing with long-term global climate variability and change.

CENR Homeland Security Committee (and associated Working Groups) – Office of Science and Technology Policy (OSTP) subcommittee and joint effort from all Federal Agencies.

Geospatial One Stop (GOS) – GIO collaboration to bring interoperability to the federal community.

Federal Geographic Data Committee (FGDC) Homeland Security Committee – the Homeland Security Program participates in the standards committee for Homeland Security and Geographic Information, map symbology, and other Homeland Security standards being developed under the FGDC.

The NASA Homeland Security Program continues to recognize the Applied Sciences Program's Crosscutting Solutions Program Element as important to the Homeland Security Program

Element. Crosscutting Solutions subelements include Solutions Network, GIO, Integrated Benchmark Systems (IBS), and Human Capital Development.

IV. Decision Support Tools and Homeland Security Issues

Priority Decision Support Systems for FY 05-09:

Interagency Modeling and Atmospheric Assessment Center (IMAAC)

Homeland Security Presidential Directive #5 (HSPD-5) assigns the Secretary of the Department of Homeland Security the role of principal Federal Official for Domestic Incident Management. To execute the responsibilities associated with this role, the Department of Homeland Security needs near-real-time information to build a common operating picture. DHS has clearly stated its need for a single point of contact for all-hazards dispersion modeling, which is the prediction of the dispersion (including transport and diffusion) of any contaminant in the environment. The Homeland Security Operations Center (HSOC, a.k.a. Watch Center) and other elements of DHS require timely and accurate weather and the capacity to model air plume forecasts of contaminant dispersion for all types of incidents and accidents.

A key component of implementing this directive is IMAAC. The IMAAC directly supports the HSOC (Watch Center) and other elements of DHS and is the single source of dispersion prediction information for chemical, biological, radiological, and nuclear (CBRN) incidents or threats.

This center provides tailored all-hazards dispersion support to DHS and its HSOC. The primary and most urgent objective is to provide the best available information for atmospheric hazard predictions so that DHS can make appropriate emergency response and consequence management decisions. The predictions benefit from NASA missions generally used for research of weather observations, such as TRMM, Terra/Aqua/Aura, CloudSAT, QuikSCAT, EO-1, and Landsat. The focus of the Homeland Security Program Element at NASA is to ensure that NASA's science results and missions are integrated into solutions for the benchmark capacity of the IMAAC and HSOC activities early in their formulation stages.

Potential Homeland Security Issues

The NASA Homeland Security Program Team continually consults with its partners to identify important issues facing the Homeland Security community, to examine associated decision support tools, and to determine priorities within the Homeland Security portfolio to evaluate the potential capacity of NASA research results to contribute to integrated solutions. Topics include the following:

- Aviation security and severe weather and precipitation to understand deposition and chemical change
- Water quality issues related to terrorism
- Air quality issues related to terrorism and air plume dispersion
- Homeland security programs for DHS
- National disaster response planning
- Interoperability and information technologies
- International disaster coordination and development
- USDA food security needs for global monitoring information

Cross-Application Activities

Air plume modeling capability developed within the HAZUS-MH model could benefit other applications, such as Disaster Management, Agricultural Efficiency, Aviation, Energy Management, Carbon Management, and Air Quality. The Defense Threat Reduction Agency (DTRA) funded an experimental pilot to incorporate an air plume model into HAZUS-MH. The Hazard Prediction and Assessment Capability (HPAC) model was demonstrated in September at FEMA. The results of this development may help guide the collaboration of the IMAAC and HAZUS-MH as a decision tool to be used by FEMA and/or state, local, and tribal governments in understanding the financial, structural, and social aspects of air plume dispersion of Chemical, Biological, Radiological and Nuclear (CBRN) Agents.

Integrated Benchmarked Systems Program (IBS)

The IBS Program is that part of the Crosscutting Solutions Program providing systems engineering services and support to perform evaluation, verification, validation, and benchmarking required by the twelve applications of national priority. System engineering services and support includes such activities as system design, synthesis, integration, requirements analysis, testing, verification, validation, and uncertainty analysis.

The goal of the Integrated Benchmarked Systems Program is to assure the integrity, quality and reliability of innovative solutions delivered by the Program to its customers, thereby enhancing the decision-making capacities of partner agencies and their customers.

The Homeland Security Program Element utilizes the IBS Program to evaluate, verify, validate, and benchmark the solutions used to improve decision support tools, such as an integrated operations facility. More information on schedule and deliverables can be found in the IBS program plan. This includes the requested amounts from the IBS program to support the Evaluation, Validation, and Benchmarking of NASA's Earth-Sun system science results into the DHS air plume-modeling center.

V. Applications Activities

A. Projects

The Homeland Security Program authorizes projects to support the Program's goal and objectives. The respective Project Managers are responsible for developing project plans and for managing activities to support the Program, the Office of Science, and its partners. Project plans specify science observations, models, and other outputs to the decision support tools. Homeland Security projects expect to use observations from sensors onboard Terra, Aqua, EO-1, Landsat, GRACE, CloudSAT, NPP, NPOESS, Aquarius, and HYDROS.

<table>
<tr><th colspan="6">Project IMAAC (Air Plume modeling and Response)</th></tr>
<tr><td colspan="4" rowspan="2">To utilize Earth-Sun system results that enhance air plume hazards observation and prediction capabilities with remote sensing and model development.
To better understand aerosol production (air quality), movement, and development using MODIS observations and modeling techniques
Goals: Air plume model/module improvements for preparedness and mitigation, with development as a response tool for the HSOC/IMAAC situation center.
To improve use of science inputs from NASA remote sensing technologies, such as TRMM, QuikSCAT, and MODIS, for air plume applications.
To bring weather analysis, models, and prediction into homeland security applications at the IMAAC.</td><td colspan="2">Budget (K)</td></tr>
<tr><td>FY05</td><td>205</td></tr>
<tr><td>Project Managers</td><td>Centers</td><td>Timeframe</td><td>Partners</td><td>FY06</td><td>450</td></tr>
<tr><td rowspan="3">Bruce Davis – SSC
Shahid Habib – GSFC</td><td rowspan="3">SSC,
GSFC</td><td rowspan="3">FY05-FY09</td><td rowspan="3">DHS/FEMA, EPA, NOAA, DOE, NRC, Navy, REASoN</td><td>FY07</td><td>255</td></tr>
<tr><td>FY08</td><td>280</td></tr>
<tr><td>FY09</td><td>150</td></tr>
<tr><td>Earth-Sun System Science Products</td><td colspan="3">ALOHA and other models, data assimilation, Landsat, Terra, Aqua, Aura, ASTER, QuikSCAT, TRMM, NPP, NPOESS, AVHRR, GOES, GPM,</td><td colspan="2">Other Apps.</td></tr>
<tr><td>Deliverables</td><td colspan="3">1) Evaluation report, agreement/joint development plan, benchmark reports, results conferences.
2) Better understanding of aerosol/plume migration using MODIS or other Science mission
3) FY05 integration of at least two Earth-Sun science datasets or products into HSOC, which helps to implement the JADPAT research and development plan</td><td colspan="2">Air Quality, Aviation, Agriculture, Water Management</td></tr>
</table>

<table>
<tr><th colspan="5">Project USDA/NASA Partnership in Homeland Security</th></tr>
<tr><td colspan="4">To improve the ability of USDA to respond to food security issues through the utilization of science results in their decision support systems.
Goals: To match science products to USDA requirements and priorities in food and plant security.
To enable improved response and to extend NASA remote sensing technologies, such as TRMM, QuikSCAT, and MODIS, to USDA to incorporate in food security operations, planning, policy, and decision support.</td><td colspan="2">Budget (K)
FY05 0
FY06 300
FY07 100
FY08 300
FY09 300</td></tr>
<tr><td>Project Managers</td><td>Centers</td><td>Timeframe</td><td>Partners</td><td colspan="2"></td></tr>
<tr><td>Steve Ambrose – HQ
Rodney McKellip - SSC</td><td>HQ</td><td>FY04-FY09</td><td>USDA</td><td colspan="2"></td></tr>
<tr><td>Earth-Sun System Science Products</td><td colspan="3">Precipitation, wind data, Landsat, Terra, Aqua, QuikSCAT, TRMM, GIFTS, NPOESS</td><td colspan="2">Other Apps.</td></tr>
<tr><td>Deliverables</td><td colspan="3">1) Partner requirements document, preliminary evaluation report, preliminary agreement or joint development plan</td><td colspan="2">Public Health, Agriculture, Water Management</td></tr>
</table>

<table>
<tr><th colspan="5">IBS Engineering Support (Support from Crosscutting/IBS Program)</th></tr>
<tr><td colspan="4">1. Refine technical requirements related to the geospatial components associated with NASA Earth observing data products for the IMAAC.
2. Advise on the selection of NASA data products for incorporation into the IMAAC
3. Perform V&V of NASA products through use of in situ measurements and ground networks and benchmark product performance through technical publication/memoranda.
4. Leverage studies of surface roughness and use of NASA and other data sets to derive surface roughness measurements for incorporation into wind and transport models.
5. Develop a “checklist” of model attributes that should be examined when comparing and evaluating models for incorporation into the IMAAC.</td><td colspan="2">Budget (Requested from IBS)
FY05 100
FY06 100
FY07 0
FY08 0
FY09 0</td></tr>
<tr><td>Manager</td><td>Centers</td><td>Timeframe</td><td>Partners</td><td colspan="2"></td></tr>
<tr><td>Rodney McKellip</td><td>SSC</td><td>FY04-05</td><td>N/A</td><td colspan="2"></td></tr>
<tr><td>Earth-Sun System Science Products</td><td colspan="3">Identified through HAZUS-MH and evaluation efforts with DHS/FEMA</td><td colspan="2">Other Apps.
Crosscutting Solutions</td></tr>
<tr><td>Deliverables</td><td colspan="3">Preliminary evaluation report, formal recommendations for action in FY2005-beyond</td><td colspan="2"></td></tr>
</table>

B. Solicitations

In 2005, the NASA Science Mission Directorate (which incorporates both the Office of Earth Science and the Office of Space Science) will release a single NRA entitled Research Opportunities in Space and Earth Sciences - 2005 (ROSES-05). The ROSES-05 announcement includes the foci of the five to ten individual Earth Science NRA's that have been routinely released by the Office of Earth Science in previous years. The ROSES-05 NRA includes all on-going research opportunities in Earth and Space science that NASA has traditionally sponsored and is the solicitation for proposals leading to selections of research tasks to be funded in FY06. Research opportunities are referred to in this NRA as "program elements," each of which is described by a single section in the Appendix. The ROSES-05 NRA may be found at: http://nspires.nasaprs.com/external/

The Homeland Security program oversees projects in the Research, Education, and Applications Solutions Network (REASoN). Currently only one project is specifically assigned to the Homeland Security Program:

University of San Diego – A Border Security Decision Support System Driven by Remotely Sensed Data Inputs. Datasets used with the program are MODIS, ASTER, Global Positioning System, AVHRR, GOES. Models used in this project are Terrain, Visibility, Vegetation, Wildfire, and Weather. User organizations are the Department of Homeland Security, First Responders, and Border Agents. This is a five-year project with total cost of $1,838,000 (FY03-07). The PI is Doug Stow, San Diego State University.

C. Congressionally Directed Activities

Activity: Congressionally directed project at the Cayuga State College, RACNE, IAGT.
Purpose: To develop geoscience technologies for state, local, and tribal communities.
Managers: Steve Ambrose, Paul Deminco (GSFC)
Goals: FY05 - To establish improved partnerships with IAGT, Affiliated States, and homeland security community;
To partner with SERVIR, GIO, and other NASA projects that utilize geospatial data and visualizations.
Budget: $1,800K

D. Project Management

The Homeland Security Program authorizes studies, working group participation, program reviews, and other endeavors to ensure the Program's overall success.

Activity: Subcommittee on Disaster Reduction (SDR) and related Remote Sensing and Applications Workgroup (RSAWG)
Purpose: To encourage Presidential focus on homeland security through this OSTP group of agencies
Manager: Stephen Ambrose (along with Roz Helz, USGS)
Goals: The SDR coordinates policy documents that are reviewed by partner agencies and signed by the OSTP. For example, the first document completed this year was "Reducing Disaster

Vulnerability through Science and Technology," otherwise known as "America at Risk." This collaborative document identified current disaster risks and agency activities. In FY05, SDR activities are structured to work closely with the Earth Observation Summit activities and implementation plans, both nationally and internationally.

Activity: State Department Partnership, Humanitarian Information Unit (HIU)
Purpose: To implement a DSS for the State Department's HIU. The HIU is interested in the Public Health and Homeland Security Programs and in the application of science results and spacecraft missions, as well as in geospatial observations issues and interoperability. This partnership also enhances homeland security applications related to population monitoring.
Managers: Steve Ambrose, Bruce Davis

E. Additional Activities and Linkages

The Crosscutting Solutions Program—The program consists of functional elements that contribute to all of the National Applications activities. The intention is to have the performance of these functions leverage accomplishment, and therefore the apparent resource investment, to the greatest extent possible into the National Applications partnerships. These functions are: Geoscience Standards and Interoperability, Human Capital Development, Integrated Benchmark Systems, and Solutions Networks. Examples of leveraged activities are:

- *The Earth-Sun System Gateway* is a "portal of portals" providing an access point through an Internet interface to all web-enabled NASA research results.
- *A Rapid Prototyping Center* is a proposed center at Stennis to support NASA and partners in testing and verification of Earth science results in decision support tools
- *Transition from Research to Operations Network (R2O)* is a network that focuses on systematically transitioning the results of research to operational uses.
- *DEVELOP* is a student-based program for rapidly prototyping solutions for state and local applications and helping students develop capabilities related to Earth-Sun System science.

NASA and Science Mission Directorate Priorities

- *Federal Enterprise Architecture (FEA)* is a business and performance-based framework to support cross-agency collaboration, transformation, and government-wide improvement.
- *The Global Information Grid (GIG)* is the first stage of a U.S. military global, high-bandwidth, Internet protocol-based communications network (a.k.a., 'the Internet in space').
- *The Joint Center for Satellite Data Assimilation (JCSDA)* is a multi-agency collaboration to accelerate and improve the quantitative use of research and operational spacecraft data in weather and climate prediction models. NOAA (NESDIS, NWS, OAR), NASA, Navy, Air Force, and NSF (through UCAR) collaborate in JCSDA.
- *Metis* is a visual modeling software tool for planning, developing, and analyzing agencies' enterprise architectures. The Applied Sciences Program is using Metis to identify possible linkages between observations, models, and decision support tools to support the IWGEO and NASA/NOAA R2O activities.
- *Observing System Simulation Experiments (OSSEs)* use simulated observations to assess the impacts of future spacecraft instruments on weather and climate prediction and

provide opportunities to test new designs and methodologies for data gathering and assimilation.

- *Project Columbia* is a NASA-wide project to develop a new, fast supercomputer (using an integrated cluster of interconnected processor systems) to support the Agency's mission and science goals, including enhanced predictions of weather, climate, and natural hazards.

The Homeland Security Program Element draws on activities supported by the Office of Science Education Program that may have potential or specific application to Homeland Security.

At this time, there are no Earth-Sun System Fellowships, Earth Sun System New Investigators, or GLOBE projects that have sufficient relevance to homeland security activities.

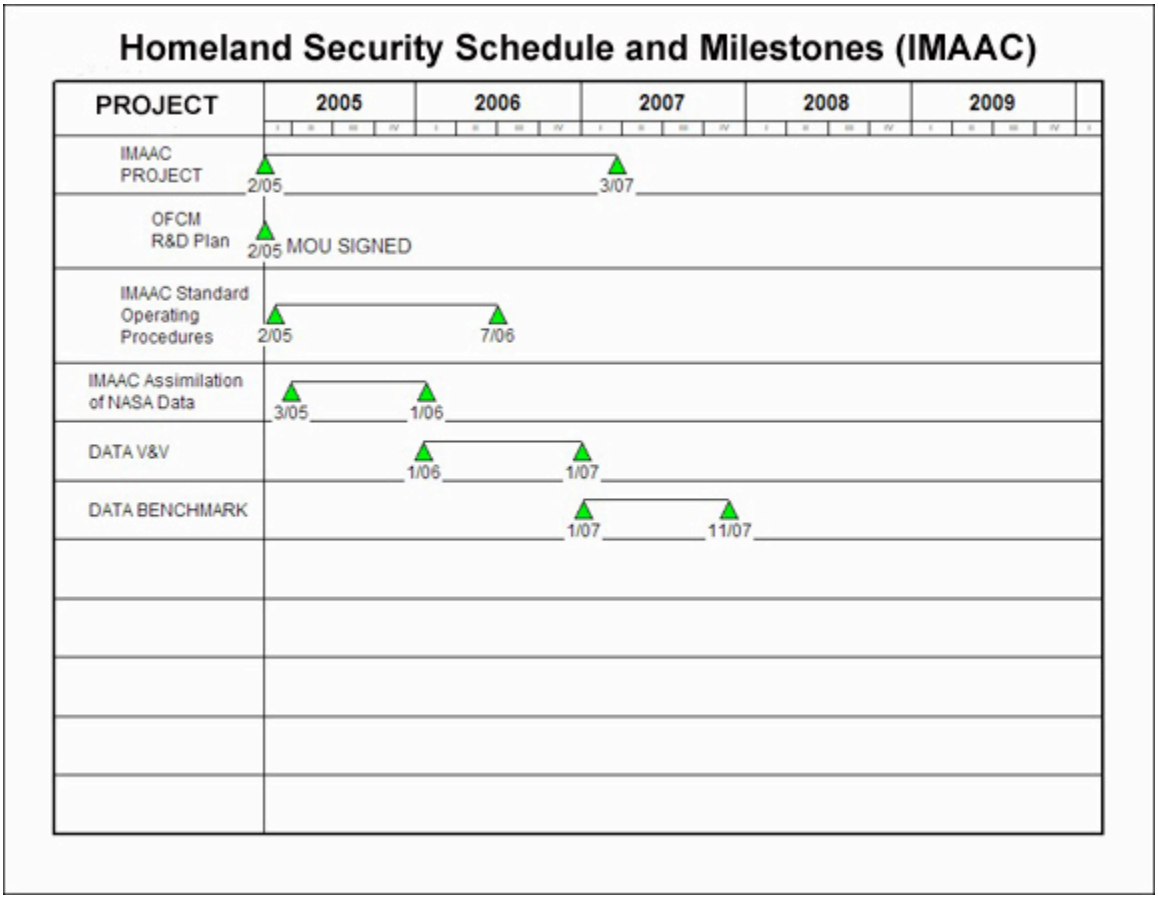
VI. Budget: Fiscal Year 2005

The following table lists the Homeland Security Program budget (procurement) for FY2005:

Homeland Security	
Project	**FY05 Procurement Allocation ($K)**
IMAAC DSS	$205
Food Security Evaluation	$0
Prog. Mgnt	$0
Total	**$205**

Appendix C lists program-wide budget allocations for FY2005.

VII. Schedule and Milestones



VIII. Performance Measures

The Homeland Security Management Team uses performance measures to track progress, to identify issues, to evaluate projects, to make adjustments, and to establish results of the Program Element. These measures serve as condition indicators to help monitor progress within and across specific project activities to ensure that the Program meets its goals and objectives. The Management Team continually analyzes these measures, tracking conditions and identifying issues to keep the Program aligned with this Plan to meet its objectives.

The Program uses two performance measures: Program Management measures assess activities within the Program, and Performance measures assess whether external program activities are serving their intended purpose. The Applied Sciences Program also uses this information in preparing IBPD directions and U.S. Office of Management and Budget (OMB) Program Assessment Rating Tool (PART) responses.

Program Management Measures (Internal)

Inputs	Potential issues and DSTs identified for Homeland Security – *number, type, range* Eligible partners to collaborate with – *number, type, range* Potential results/products identified to serve Homeland Security – *number, type, range*
Outputs	Assessments or evaluations of DSTs – *number, range* Assessments of Earth-Sun System Science results/products to serve DSTs – *number, range* Agreements with partners – *presence* Reports (evaluation, validation, benchmark) – *number, type*
Quality and Efficiency	Science results/products – *number used per DST, ratio of utilized to potential* Agreements – *ratio of agreements to committed partners* Reports – *partner satisfaction, timeliness, time to develop* Reports – *ratio of validations to potential products, ratio of benchmarks to validations*

Performance Measures (External)

Outcomes	Science products adopted in DSTs – *number, type, range; use in DST over time* Science products in use – *ratio of products used by partners to reports produced* Partner and DST performance – *change in partner DST performance, number & type of public recognition of use and value of Earth-Sun System Science data in DST*
Impacts	Partner value – *change in partner metrics (improvements in value of partner decisions)*

In addition to the stated measures, the Homeland Security Program periodically requests an assessment of its plans, goals, priorities, and activities through external review. The Homeland Security Program team uses these measures, along with comparisons to programmatic benchmarks, to support assessments of the Science Applied Sciences Program (e.g., internal NASA reviews and OMB PART). Specifically, the Homeland Security Program manager uses comparisons to similar activities in the following programs (i.e., program benchmarks) to evaluate its progress and achievements:

- Environmental and Societal Impacts Group at the National Center for Atmospheric Research (NCAR)
- Global Monitoring for Environment and Security (GMES)

FY05 Performance Measures - IBPD

This Program serves the following IBPD Performance Measures for FY04 and FY05:

Outcome 3.1.1: By 2012, in partnership with the Department of Homeland Security, the Department of Defense, and the Department of State, the Applied Sciences Homeland Security Program will deliver fifteen observations and five model predictions for climate change, weather prediction, and natural hazards to five national and five global organizations and decision makers

to evaluate five scenarios and to optimize the use of Earth resources (e.g., food, water, energy) for homeland, environmental, and economic security.

Goal 5ESA9: The Homeland Security Program will benchmark the use of predictions from two Earth-Sun system science models (including the Goddard Institute for Space Studies (GISS) 1200 and National Centers for Environmental Prediction (NCEP) numerical weather prediction models such as ETA) for use in national priorities, such as National Security, and for support of the CCSP, and the CCTP, and the NOAA National Weather Service.

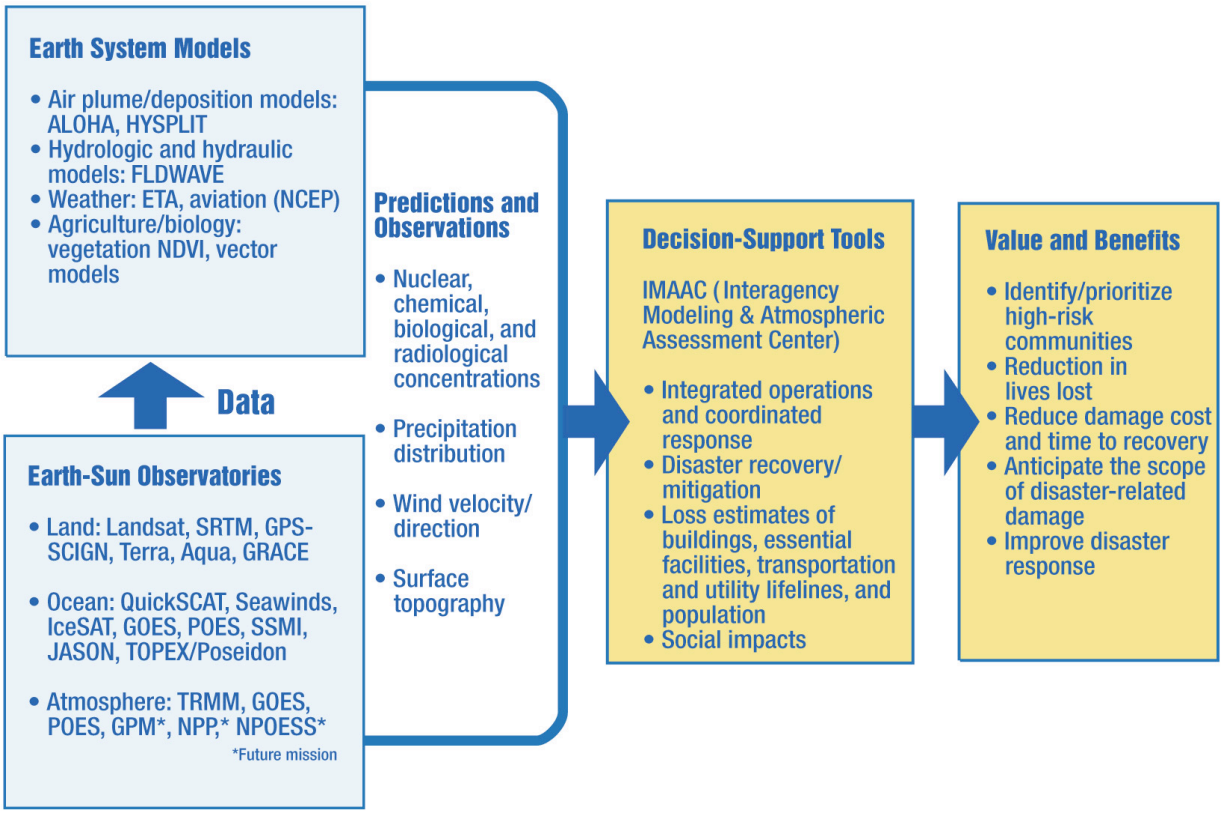
FY06

The Homeland Security Program cuts across many of the Applied Sciences Program's National Applications. Weather and climate play a major role in Homeland Security activities, including air quality monitoring. NASA's Homeland Security Program works directly with the DHS (IMAAC) for air plume modeling.

IX. Appendices

Appendix A. Integrated System Solutions Diagram

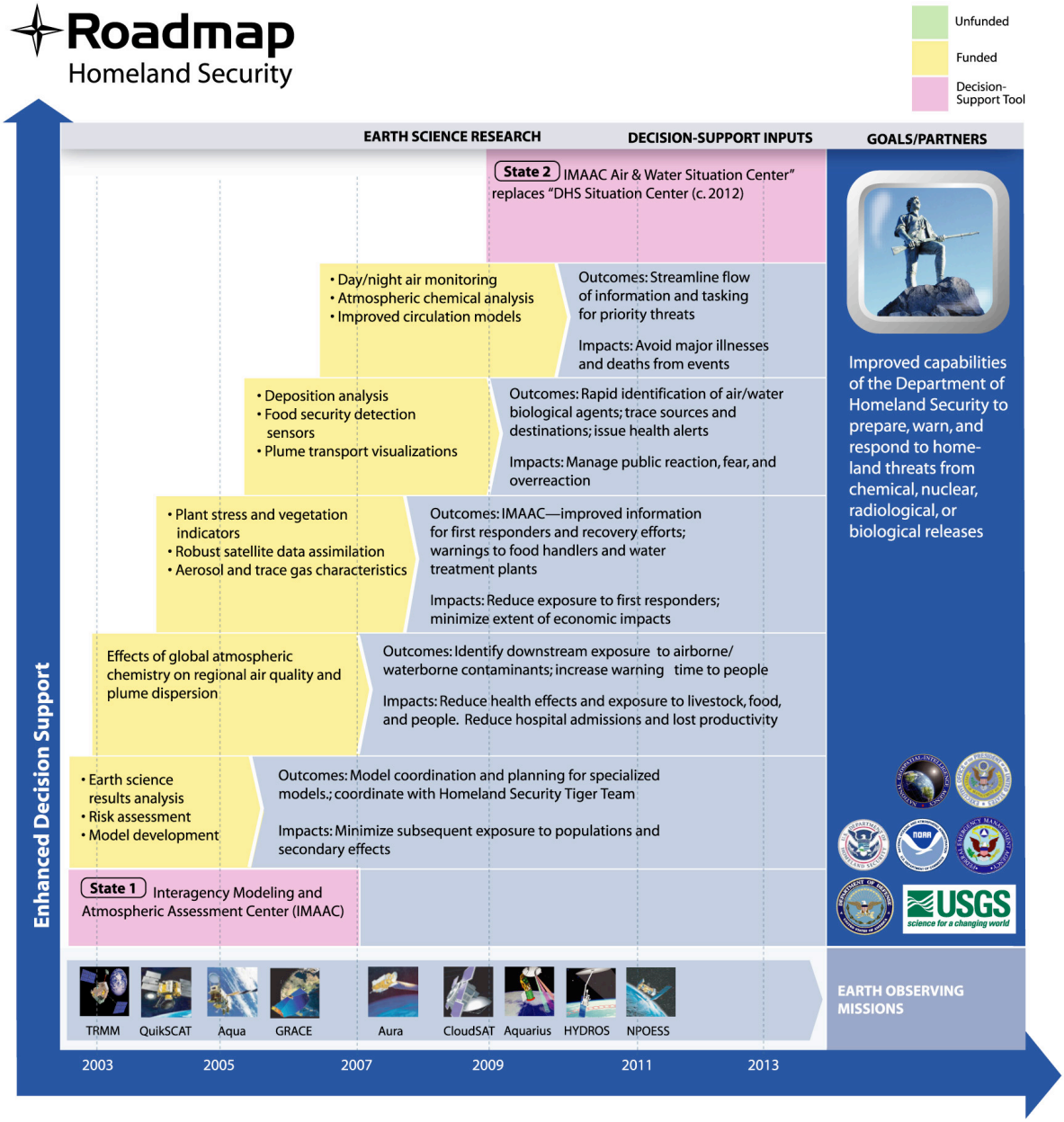
The figure below illustrates how science measurements, model products, and data fusion techniques support the Homeland Security Program's partners and their decision support tools and shows the value and benefits of science to society.



Appendix B. Roadmap

The Homeland Security Roadmap was developed in collaboration with the Sun-Earth System Division's Research and Analysis Program Plan to ensure that the priorities of science results are carried forward to homeland security applications that utilize the investment of science research and technology.

For example, a better understanding of air plume chemistry and deposition would greatly benefit Homeland Security's air plume modeling needs. Parameter modeling at the global scale can greatly improve information quality at the local and regional scales.



Appendix C. Applied Sciences Program Budget FY2005

The overall program budget allocations are given below to provide the context in which this National Application is conducted. The allocations are based on Agency and program priorities and are subject to change according to the availability of funds and programmatic strategies. All values are in $ thousands.

*NOTE: Allocations include full utilization of the Applied Sciences FY04 carryover of approximately $2.7 million.

Table 1: Applied Sciences Procurement Allocation – FY05

Program Element	FY05 Procurement Allocation
National Applications	
Agricultural Efficiency	$ 467
Air Quality Management	$ 995
Aviation	$ 750
Carbon Management	$ 653
Coastal Management	$ 550
Disaster Management	$ 545
SENH	$ 1,429
Ecological Forecasting	$ 610
Energy Management	$ 775
Homeland Security	$ 205
Invasive Species	$ 205
Public Health	$ 725
Water Management	$ 870
Program Director Discretionary Fund	$ 588
Center Director Discretionary Fund Tax	$ 2,485
National Applications Total	$ 11,852
Crosscutting Solutions	
Integrated Benchmarked Systems	$ 3,529
Solutions Networks	$ 1,200
Competitive Solicitations	$ 7,600
Human Capital Development	$ 700
Geoscience Standards & Interoperability	$ 2,000
Crosscutting Solutions Total	$ 15,029
Applied Sciences Program Procurement Total	***$ 26,881***

Table 2: Applied Sciences Program NASA Institutional Allocations – FY05

NASA Center	FY05 Institutional Cost / National Applications	FY05 Institutional Cost / Crosscutting Solutions	Institutional Total
HQ	$3,773	$7,351	$11,124
ARC	$1,108		$1,108
GSFC	$1,009	$1,094	$2,103
JPL			
LaRC	$1,517	$444	$1,961
MSFC	$1,251	$183	$1,434
SSC	$3,194	$8,689	$11,883
Total	***$11,852***	***$17,761***	***$29,613***

Appendix D. Acronyms and Websites

ACRONYMS:

AIWG	Applications Implementation Working Group
ALOHA®	Aerial Locations of Hazardous Atmospheres
ARC	Ames Research Center
ASTER	Advanced Spaceborne Thermal Emission and Reflectance Radiometer
AVHRR	Advanced Very High Resolution Radiometer
CALIPSO	Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations
CBRN	Chemical, Biological, Radiological, and Nuclear
CCRI	Climate Change Research Initiative
CCSP	Climate Change Science Program
CCTP	Climate Change Technology Program
CENR	Committee on Environment and Natural Resources
DAAC	Distributed Active Archive Center (Data Active Archive Center)
DFRC	Dryden Flight Research Center
DHS	Department of Homeland Security
DOD	US Department of Defense
DOE	US Department of Energy
DSS	Decision Support Systems
DST	Decision Support Tool
DTRA	Defense Threat Reduction Agency
EO-1	Earth Observing-1
EOS	Earth Observing Systems
EPA	US Environmental Protection Agency
ESG	Earth-Sun System Gateway
ETA	Event Tree Analysis
ETM+	Enhanced Thematic Mapper Plus
FCMSSR	Federal Committee for Meteorological Services and Supporting Research
FEA	Federal Enterprise Architecture
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
GIFTS	Geosynchronous Imaging Fourier Transform Spectrometer
GIG	Global Information Grid
GIO	Geospatial Interoperability Office
GISS	Goddard Institute for Space Studies
GLOBE	Global Learning and Observations to Benefit the Environment
GMES	Global Monitoring for Environment and Security
GOES	Geostationary Operational Environmental Satellite
GOS	Geospatial One Stop
GPM	Global Precipitation Measurement
GRACE	Gravity Recovery and Climate Experiment
GSFC	Goddard Space Flight Center
HAZMAT	Hazardous Materials Response Division
HAZUS	Hazard- United States
HAZUS-MH	Hazard- United States - Multi-Hazard
HIU	Humanitarian Information Unit
HPAC	Hazard Prediction and Assessment Capability

HSOC	Homeland Security Operations Center
HSPD-5	Homeland Security Presidential Directive #5
HSTT	Homeland Security Tiger Team
Hydros	Hydrosphere State Mission
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
IBPD	Integrated Budget and Performance Document
IBS	Integrated Benchmarked Systems
IMAAC	Interagency Modeling and Atmospheric Assessment Center
INSAR	Interferometric Synthetic Aperture Radar
IWGEO	Interagency Working Group on Earth Observations
JADPAT	Joint All-Hazards Dispersion Planning and Analysis Team
JAG	Joint Action Group
JCSDA	Joint Center for Satellite Data Assimilation
JPL	Jet Propulsion Laboratory
LaRC	Langley Research Center
MM5	Mesoscale Model
MOA	Memorandum of Agreement
MODIS	Moderate Resolution Imaging Spectroradiometer
MOPITT	Measurements Of Pollution In The Troposphere
MSFC	Marshall Space Flight Center
NASA HQ	NASA Headquarters
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NCEP	National Centers for Environmental Prediction
NEESPI	Northern Eurasia Earth Science Partnership Initiative
NESDIS	National Environmental Satellite Data Information Service
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPOESS	National Polar-Orbiting Operational Environmental Satellite System
NPP	NPOESS Preparatory Project/Net Primary Productivity
NRC	Nuclear Regulatory Commission
NWS	National Weather Service
OAR	Office of Oceanic and Atmospheric Research
OFCM	Office of the Federal Coordinator for Meteorology
OMB	Office of Management and Budget
OR&R	Office of Response and Restoration
OSSE	Observing System Simulation Experiment
OSTP	Office of Science and Technology Policy
PART	Program Assessment Rating Tool
QuikSCAT	Quick Scatterometer
R2O	Research to Operations Network
R&D	Research and Development
REASoN	Research, Education, and Applications Solutions Network
RSAWG	Remote Sensing and Applications Working Group
SDR	Subcommittee on Disaster Reduction
SeaWiFS	Sea-viewing Wide-Field-of-View Sensor
SRTM	Shuttle Radar Topography Mission
SSAI	Science Systems and Applications Inc.
SSC	Stennis Space Center
TM	Thematic Mapper
TRMM	Tropical Rainfall Measurement Mission

UCAR	University Corporation for Atmospheric Research
USDA	US Department of Agriculture
USWRP	United States Weather Research Program
V&V	Verification and Validation

WEBSITES:

DHS: http://www.dhs.gov

Research Opportunities in Space Science (ROSS):
http://research.hq.nasa.gov/code_s/nra/current/NNH04ZSS001N/index.html

AIWG: http://aiwg.gsfc.nasa.gov/

Applied Sciences Program: http://science.hq.nasa.gov/earth-sun/applications

DEVELOP: http://develop.larc.nasa.gov

Earth-Sun System Gateway (ESG): http://esg.gsfc.nasa.gov/

Earth-Sun Science System Components: http://www.asd.ssc.nasa.gov/m2m

NASA FY2005 Budget: http://www.ifmp.nasa.gov/codeb/budget2005

Research and Analysis Program: http://science.hq.nasa.gov/earth-sun/science/

Science Mission Directorate: http://science.hq.nasa.gov

Science Strategies: http://science.hq.nasa.gov/strategy/